

**REMARKS**

Claims 1-8 are all the claims pending in the application. Claims 4-8 have been previously withdrawn from consideration by the Examiner.

Reconsideration and review of the claims on the merits are respectfully requested.

***Preliminary Matters***

Applicants kindly thank the Examiner for acknowledging and returning a signed and initialed copy of the Form PTO/SB/08 A & B (modified) submitted on December 13, 2002.

Applicants appreciate that the Examiner has accepted the drawings filed on August 4, 2003.

***Claim Rejections - 35 U.S.C. § 102***

Claims 1-3 are rejected under 35 U.S.C. § 102(e) as assertedly being anticipated by Ngo et al (US Pat. No. 6,303,505) for the reasons given in the Office Action.

The Examiner states that Ngo et al discloses forming a copper-containing film on a semiconductor substrate in accordance with the present invention. Specifically, the Examiner asserts that Ngo discloses, e.g., applying a nitriding treatment to the surface of said copper containing film from which the copper oxide has been removed (Col. 5, line 66-Col. 6, lines 6-15); and forming a copper diffusion prevention film (40) comprising a silicon on said copper containing film which has been subjected to the nitriding treatment.

Applicants respectfully traverse the rejection.

The present invention claims as one of its steps applying a nitride treatment to the surface of a copper-containing film from which the copper oxide has been removed. From this nitride treatment, a *copper nitride layer* is formed.

On the other hand, Ngo discloses that, subsequent to the treatment of Cu or Cu alloy interconnect with a hydrogen containing plasma, the cleaned surface of the Cu or Cu alloy interconnect member can be reacted with silane or dichlorosilane to form a thin layer of *copper silicide 40* on the Cu or Cu alloy interconnect (See Ngo, col. 4, line 66 to col. 5, line 7; and Figs. 4-5, element 40 - copper silicide layer). In other words, Ngo produces a thin copper silicide layer by silane treatment. However, Ngo does not disclose or teach forming a *copper nitride layer* as required by the present invention. Furthermore, element 40 in Ngo does not represent a copper diffusion prevention film. Instead, Ngo discloses that element 50 is a copper diffusion prevention film made of silicon nitride (See Ngo, col. 7, lines 8-11; and Fig. 5, elements 40 and 50).

The present invention describes that a copper nitride layer is formed first and then a copper silicide layer is formed afterwards, once a silicon nitride film 18 is formed as a copper-diffusion prevention film. During this step of silicon nitride film growth, silicon is diffused, through the pre-existing distinct copper nitride layer 24, into the copper interconnection 17, to form a distinct *copper silicide layer 25* (See Fig. 3(a)).

Since the nitriding treatment is applied to a clean copper surface where no copper oxide film remains, the film thickness and the film quality of a *copper nitride* film which is formed by

**RESPONSE UNDER 37 C.F.R. § 1.111**

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the nitriding treatment can be made uniform and the film thickness of a copper silicide layer to be formed in the copper interconnection becomes uniform. As a result, beneficial effects can be attained. (See bridging paragraph of pages 7-8; page 23, second full paragraph; and Fig. 2(c), element 24 - copper nitride film).

For the foregoing reasons, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 102(e) and allowance of the pending claims.

***Conclusion***

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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